helpful suggestions. I am thankful to Dr. S. N. Banerjee, Plant Protection Adviser to the Government of India, Faridabad for the facilities.

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May 29, 1978.

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27. OBSERVATIONS ON THE SILK CHAMBER CONSTRUCTION AND BROODING BEHAVIOUR OF PSEUDOSCORPIONS (CL. ARACHNIDA)

(*With five text-figures*)

It is the habit of pseudoscorpions to build chambers of silk which are used for breeding, moulting and hibernation (Gabbutt and Vachon 1965). The silk chamber is generally constructed with the help of the spinneret or galea, situated at the distal end of the fixed finger of chelicera (fig. 1a). The silk glands lie in the prosoma and ducts pass along the fixed finger and open at the tip of the galea (fig. 1b) or the spinneret. Savory, T.H. (1935) pointed out the homology of the silk apparatus with that of the poison apparatus of Araneae. It is to this presence of the silk glands in the chelicerae, the false scorpions owe the name chelonethi, given by Thorell.

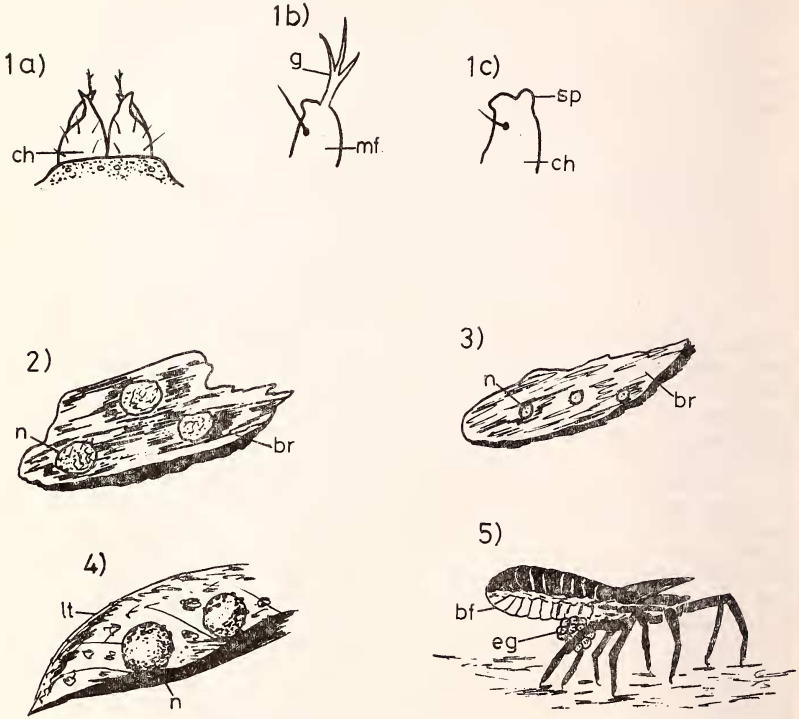
By the issue of silk glands, the chambers of silk are constructed in damp places underneath the barks of trees by the bark dwelling forms or under decaying leaves of debris by litter inhabiting pseudoscorpions. It is of interest to know whether the method of construction, the period of nesting and the reaction towards external disturbance differ among the members of the three different suborders namely *Monosphyronida, Diplosphyronida* and *Heterosphyronida,* inhabiting different habitats. Furthermore, extensive work has been done in the field of population dynamics of pseudoscorpions in different parts of the world (Kew 1914; Morikawa 1962; Gabbutt and Vachon 1965). However, during the studies they have failed to take into consideration nested forms, which may influence the population fluctuation remarkably. In this connection, a statistical allowance has been thought of during the present investigation.

METHODS

Tullgrenius indicus, Calocheiridius elegans and *Lechytia indica* were taken up for observation as members of the suborders namely Monosphyronida, Diplosphyronida and Heterosphyronida respectively. For each species 10 individuals were observed at the time of nesting, moulting, brooding and hibernation with reference to their behaviour variations.

OBSERVATIONS

Tullgrenius indicus : (Table-1): This species was seen beneath the bark of tamarind trees. During breeding season, the gravid female carries 10 to 12 eggs attached to the genitalia as a spherical mass and covered by a thin membrane. With the help of the branched galea the female deposits the silk in an irregular fashion between the stem and the bark



Figs. 1-5. 1) Chelicerae of *Tullgrenius indicus;* 1b) galea; 3) spinneret of *Lechytia indica.* 2) Nests of *T. indicus.* 3) Nests of *Calocheiridius elegans.* 4) Nests of *L. indica.* 5) *T. indicus* female carrying eggs.

Abbrevitations

bf—brooding female of *Tullgrenius indicus,* br—bark of tree, ch—chelicera, eg—egg cluster, g—galea, lt—litter, mf—movable finger, n—nest, sp—spinneret.

of the tree. The deposition of sand grains and tiny bark particles over the completed nest have been observed. The males and the females hibernate during winter (December and January), but the females club the brooding during that period. At a time, below a bark 5 to 7 nests have been observed with the least gap of 0.5 mm between two nests. Invariably the ramification of the hyphae of saprophytic fungi like *Penicillium* and *Aspergillus* have been observed over the silken chambers. (Fig. 2).

After about four weeks the protonymphs hatch from the eggs and remain with the mother inside the nest and they feed on the exudation from the mother. During moulting the three nymphal stages (Protonymph, deutonymph and tritonymph) build nests and the diameter of the nest varies from 6 to 8.5 mm. The brooding female constructs the largest chamber.

Calocheiridius elegans : (Table 1): This species occurs beneath the bark of tamarind trees. During the breeding season the gravid female extrudes 6 to 8 eggs which remain attached to the genitalia and present a rousette-like appearance.

At that time, the gravid female, with the help of the galea issues sticky silk and screens the gap between the stem and the bark of the tree. The deposition of coarse wood particles over the completed nest has been observed. The males and females hibernate during winter, during that period the females also exhibit the brooding of eggs while in the silken chamber. At a time, 4 to 5 nests have been observed below a piece of bark with the least gap of 4 cm. Fungal growth over the nest has been observed in this species also (Fig. 3).

After about three weeks the protonymphs hatch from the eggs and remain with the mother till moulting. The nymphs also build nests during moulting and the size of the nest varies among the three nymphal stages. The diameter of the nest varies from 2.5 to 4 mm and the brooding female constructs the largest nest.

Lechytia indica : (Table 1): This species was observed beneath decaying leaves of soil litter. During brooding, the gravid female having 5 to 6 eggs as globular mass, moistens the leaf with silk from the spinneret (fig. 1c). Gradually debris and sand particles deposit over the wet silk. Some times the nest appears like a ball of insect faecal matter. The size varies from 1 to 3 mm in diameter (Fig. 4).

Since winter migration from litter to soil is predominant and is subsequently followed by hibernation in silken chambers, the individuals are fewer in number during sampling.

In all these forms, when the nest is disturbed the animal comes out immediately and in the case of brooding female the brood sac is discarded. (Fig. 5). Besides, they cease to construct another silken chamber for a minimum period of 20 days. When the nymphal forms undergoing moulting were disturbed, they died within a period of 2 hrs. due to lack of chitinization. The body cavity of the dead animals showed the presence of fungal hyphae.

Discussion

The Chelonethi use their nest solely for protection and the form of construction varies. Among bark inhabiting pseudoscorpions, *Tullgrenius indicus* and *Calocheiridius elegans* there is lesser deposition of sand grains or wood particles on their nest, whereas in *Lechytia indica,* a litter inhabitant, the deposition of decaying matter and sand grains is more, which gives strength and protection to the nest. In bark dwelling forms probably due to

TABLE 1

THE NATURE OF SILK CHAMBER CONSTRUCTION AND THE PERIOD OF NESTING AMONG PSEUDOSCORPIONS

Suborder and name of species	Silk issuing organ of chelicera	Shape of the nest	Diameter of nest (in mm)	Additional substances	Period of nesting in days
MONOSPHYRONIDA					
Tullgrenius indicus	branched galea	irregular	6 to 8.5	Coarse sand and wood particles	21 to 30
DIPLOSPHYRONIDA					
Calocheiridius elegans	branched galea	circular	2 to 4	Coarse wood particles	20 to 24
HETEROSPHYRONIDA					
Lechytia indica	spinneret	globular	1 to 3	Sand particles and decaying matter	30 to 50

the availability of controlled microclimate, the additional substances are not much utilized. It may be inferred here that the variation in the mode of construction of silken chamber depends upon the habitat of the pseudoscorpion.

Further pseudoscorpions undergo nesting during winter and the nymphs moult throughout the year. Similar conditions that influence the population study of pseudoscorpions, have been observed in the life history analyses of pseudoscorpions by Gabbutt and Vachon (1965). In this connection Gabbutt (1970) has stressed the inclusion of nested forms in population recordings to arrive at a probable figure. The suggestion of Gabbutt (1970), does not seem to be sound since it has been observed that the encumbered female rejected the brood-sac when disturbed, thereby depleting the number of individuals during the next sampling. In addition, the mortality rate of nymphs increases when the nests are disturbed during collection.

Thus, the present study suggests that nested forms should not be disturbed during population analysis and a statistical modulation could be introduced inorder to incorporate the nested forms in the population dynamics.

ACKNOWLEDGEMENTS

We are indebted to Prof. Dr. T. K. Raghunatha Rao for the help and advice rendered during the course of investigation. Our sincere thanks to Principal, Loyola College for evincing keen interest and for his continuous encouragement throughout our work.

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28. SOME INTERESTING OBSERVATIONS IN *WRIGHTIA TINCTORIA* R.BR. SSP. *TINCTORIA*

(*With a text-figure*)

An interesting specimen of *Wrightia tinctoria* R. Br. ssp. *tinctoria* was collected by the senior author from Kumbharli ghat, about 12 kms from Koyna, Maharashtra during a botanical exploration tour in April 1978.

The species *W. tinctoria* R. Br. has been divided into two subspecies namely ssp. *tinctoria* and ssp. *rothii* by P. T. Pgan (1965). The specimen (Nayar 153166) collected from Kumbharli ghat differs from *W. tinctoria* ssp. *tinctoria* in the following characters:

1) Inflorescence less lax
2) Pedicel not exceeding 12 mm.
3) Corolla lobes acute
4) Corona segments not distinguishable as supplementary segments and alternipetalous segments.

The most interesting observation made was on the nature and arrangement of the corona segments. Pgan (1965) has described the structure of corona in *W. tincotria,* wherein he has explained the arrangement of corona segments in three distinct series, i.e. supplementary segments, alternipetalous segments and antepetalous segments. Pgan had noticed some variations in the corona segments of *W. tinctoria* (Fig. 1, A-A3).

The variations observed in the corona segments of the specimen (Nayar 153166), however do not agree with any of the variations as shown in fig. 1 (A-A3). On a critical study it was observed that the corona segments

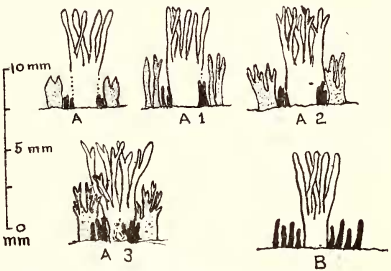

Fig. 1. A-A3: Diagrams showing variation in corona structure; antepetalous segments white, alternipetalous segments dotted; supplementary segments solid black.
B: Diagram showing an inner row of segments (solid black) indistinguishable as alternipetalous segments and supplementary segments; antepetalous segments white.